



Profile Similarity Metrics Increase Personality Scale Validity

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Personality Tests



- Modest scale validity & minor adverse impact
- Scale scores often computed as the mean item rating with some item ratings corrected for directionality.
 - Pursue physical activities: non-reversed (straight) coded
 - Avoid Physical Activities: reversed coded
- **Research Goal – Explore use of Profile Similarity Metrics (PSMs) and Consensual Standards to increase scale validity**



Personality Tests & Distance Metrics



- Conventional and distance scores are redundant: $r = -1.00$

Fitness Motivation	Rating	Conventional Score	Key	Distance Score	Sum
Non-reversed Items:	1	1	5	4	5
“Like to exercise...”	2	2	5	3	5
	3	3	5	2	5
	4	4	5	1	5
	5	5	5	0	5
Reversed Item Scores	1	5	1	0	5
“Like to watch TV...”	2	4	1	1	5
	3	3	1	2	5
	4	2	1	3	5
	5	1	1	4	5

➤ Suggests PSMs may increase scale validity



D² and Shape



- Conventional D² formula:

$$D^2 = \sum (X_i - K_i)^2 / n \text{ for item } i = 1 \text{ to } n \quad (\text{Eq 1})$$

where X_i and K_i correspond to observed ratings/values from response profile, X , and the scoring key, K , for item i

- Statistical substitutions for sd_x^2 , sd_k^2 , and r_{xk} , provide: (Eq 2)

$$D^2 = \Delta_{\text{Elevation}}^2 + ((n-1)(sd_x^2 + sd_k^2 - 2sd_x sd_k r_{xk})) / n$$

where $\Delta_{\text{Elevation}} = X_{\text{mean}} - K_{\text{mean}}$

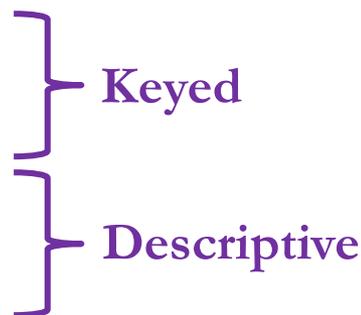
- PSMs:

– Shape = $r_{x,k}$

– Delta = $\Delta_{\text{Elevation}}^2 = (X_{\text{mean}} - K_{\text{mean}})^2$

– Scatter = sd_x^2

– Elevation = X_{mean}





Research Design



- **Analyze personality data used to award ROTC scholarships (i.e., two years of operational data)**
 - Cadet Background Experience Form (CBEF): 91 items
 - Sample size by scale ranged from 783 to 1786 because scale content changed over years
- **Longitudinal Design: Validated measures against 2nd-year program disenrollment (reversed continuance)**
- **Design Constraints/Threats**
 - Scales were not developed for PSM analyses
 - Some scales do not have reversed items
 - Not all scales predict disenrollment
 - Disenrollment is a low probability event ($p = .16$)
 - Validated personality data from high school students (grades 11 & 12) against program disenrollment (university year 2)



Expectations & Hypotheses



- PSMs account for most of the variance in Conventional/distance scores: $R^2 > .90$
- PSMs computed with the conventional key will increment the prediction of distance scores.
- Consensual scoring standards may enhance scale validity



CBEF Scales



Ratio: "Reversed" to All items	Scale	Definition
2/4	Igoal	Goal Orientation
3/8	PWP	Past Withdrawal Propensity
3/8	FM	Fitness Motivation
2/6	IntLd	Interest In Leadership
2/7	Lie	Social Desirable Responding
2/8	ES	Equity Sensitivity
1/5	TFI	Tolerance for Injury
1/8	Manip	Manipulativeness
1/11	ST	Stress Tolerance
1/14	AI	Army Identification
0/6	SE	Self Efficacy
0/6	PrLd	Peer Leadership
0/9	Ach	Achievement
0/4	Cch	Coaching
0/4	Hst	Hostility to Authority



Distance Scores Regressed on PSMs



- PSMs account for nearly all distance score variance
 - Primarily shape and scatter when item ratios > .25
 - Primarily elevation when item ratios < .25

Scale (Item Ratio)	R	β -Shape	β -Scatter	β -Delta ²
IGOAL (2:4)	.94	-.94	.07	.05
PWP (3:8)	.99	-.44	.70	.19
FM (3:8)	.99	-.48	-.59	.13
IntLd (2:6)	.98	-.34	-.73	.10
LieCon (2:7)	.91	.02	.90	.05
ES (2:8)	.99	-.45	.40	.41
TFfl (1:5)	.96	-.52	-.28	.44
Manip (1:8)	.99	-.30	.20	.70
ST (1:11)	.98	-.32	-.14	.75
AI (1:14)	.97	-.40	-.08	.62

Model Statistics: (df = 3, 776-1782), (All F-statistics > 2361.733), all models and coefficients significant unless otherwise indicated.

Lie Conventional is scored dichotomously.



Incremental Validity of PSMs Over Distance Scores on Disenrollment



- Documented potential validity gains:
 - 3 of 4 conceptually relevant scales
 - 4 of 10 scales with reverse items

Scale	Hierarchical Analysis				PSM Model		PSM Model Coefficients					
	R	R	R ²	Sig	R	Sig	Shape		Scatter		Delta ²	
	Dist Step 1	PSMs Step 2	change	F change		F change	β	p	β	p	β	p
IntLd	.01	.14	.020	.001	.14	.001	-.130	.002	.124	.003	.073	.060
AI	.06	.12	.011	.001	.09	.002	-.021	ns	.032	ns	.078	.026
Manip	.04	.11	.011	.014	.09	.038	-.009	ns	.081	.015	-.077	.104
Lie	.07	.09	.005	.061	.09	.003	.052	.074	.066	.005	-.016	ns

- No significant gains for FM, Igoal, PWP, ST, TFI, & ES



Understanding Gains



- Distance scores represent poorly weighted composites to predict continuance
 - Compare regression equations for Distance versus Disenrollment on PSMs

Scale	Outcome	PSM Model Coefficients			
		R	β -Shape	β -Scatter	β -Delta ²
IntLd	Disenroll	.15	-.13	.12	.07
	Distance	.98	-.34	-.73	.10
AI	Disenroll	.13	-.02	.03	.08
	Distance	.97	-.40	-.08	.62
Manip	Disenroll	.12	-.01	.08	-.08
	Distance	.99	-.30	.20	.70
Lie	Disenroll	.10	.05	.07	-.02
	Conventional	.91	.02	.90	.05



Incremental Validity of Consensus Distance Over Simple Distance



Scale	Hierarchical Analysis				Distance Loadings			
	R	R	R ² change	Sig F change	Simple		CBA	
	Simple D Step 1	Consensus D Step 2			β	<i>p</i>	β	<i>p</i>
PrLd	.02	.14	.019	.001	-.04	ns	.139	.001
IntLd	.02	.15	.022	.001	-.01	ns	.151	.001
AI	.06	.11	.008	.001	.02	ns	.101	.001
Ach	.02	.05	.002	.056	-.01	ns	.05	.056

- **Suggests potential validity gains for the Peer Leadership Scale**
- Consensus validity gains for the Interest in Leadership and Army Identification do not increment the PSM models for those scales



Conclusions / Questions



- Modest validity gains using PSMs and consensual standards to score conventional personality scales
 - Distance scores represent poorly weighted PSM composites
 - Design weaknesses may minimize gains
- Larger gains for conceptually relevant scales:
 - Interest in Leadership
 - Peer Lead
 - Army Identification
 - Lie

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